SOME NOTES ON THE SOUTH AFRICAN OXALIS OF THE SECTION CERNUAE.

(With Plates I-V.)

By

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A great deal of confusion has arisen in the past between the various species of Oxalis in the Section Cernuae, *i.e.* the species which have an umbellate inflorescence. Those with yellow flowers form a fairly natural group, but attempts have hitherto been made to distinguish the remainder (with reddish-purple, violaceous or white flowers) mainly by the shape of the leaflets, a character which is not always reliable and it is suggested that it is only by the study of the root-system that these plants can be grouped and determined.

In some cases it is almost impossible to identify them with certainty unless the root-system is examined some time after the flowering period, that is when the mode of vegetative reproduction can be ascertained and, since many practical difficulties present themselves in the field, such study can be more conveniently carried out in cultivation.

In the analytical keys which follow, in order to bring the plants into more natural groups, it has been found necessary to use the underground characters to a large extent and to reduce the leaf characters to a subordinate position. The floral characters have not been found of much value.

Two new sub-sections have been introduced and of the existing subsections in Das Pflanzenreich—Oxalidaceae (1930), R. Knuth, four only have been retained and two of these with revised definitions. The species have in some cases been transferred from one to another. Only species which are known to me from living or dried plants have been included.

It may be contended that a key based mainly on characters which are usually missing is of little value to the herbarium botanist, for, unfortunately, the majority of the specimens in herbaria are without the bulb and are, therefore, of little value. I must confess that there are some specimens in my own collection, in the sub-section Lividae, that I am unable to determine for this reason. On the other hand, it will be readily understood, from the detailed discussion of some of the species hereinafter, that it is not possible to determine these plants correctly by any existing key, even if the root-system is known, for this character has been almost entirely neglected in the descriptions of the species.

Many of the conclusions reached are the result of observation of the root-system in plants which, by the courtesy of the Director, I have had under cultivation in the National Botanic Gardens at Kirstenbosch.

KEY TO THE SUB-SECTIONS.

Flowers yellow. .. .. I. EU-CERNUAE.
Flowers reddish, rose, pale violaceous or white.
    Leaflets more or less bilobed.
        Bulb without an apical beak.
            Caulescent: bulb tunics longitudinally ridged, pilose at the apex: peduncles, or at least one cauline: pedicels and sepals glandular. II. LIVIDAE.
            Stem not exserted: bulb tunics smooth. entirely glabrous: peduncles basal. .. .. .. III. PURPURATAE.
            Underground stem or rhizome absent, the petioles and peduncles arising direct from the bulb. (*Introduced from Central America.*) Section IONOXALIS (Small) Knuth. .. .. .. *O. latifolia.*
        Bulb with an apical beak.
            Outer bulb tunics conspicuously longitudinally ridged. .. .. IV. COSTATAE.
            Outer bulb tunics smooth. .. .. .. V. STELLATAE.
    Leaflets entire. .. .. VI. GOETZEA.

SUB-SECTION I EUCERNUAE R. Knuth.

Stem branching.
    Robust plant up to 70 cm. high: leaves opening after flowering. .. .. *Knuthiana.*
    Lax plant up to 16 cm. high: leaves opening with flowers. *Schaeferi.*
Stem simple or none.
    Petioles conspicuously flattened: bulb tunics soft, brown. *compressa.*
    Petioles terete.
        Leaflets widely cuneate-obcordate or bilobed to near the middle.
            Bulb tunics soft, brown. .. .. *pes caprae.*
            Bulb tunics hard, with conspicuous longitudinal ribs, pale ashy grey.
                Stem exserted: peduncles 2—4-flowered: stamens not exserted. .. .. .. *haedulipes.*
                Stem not exserted: peduncles 1—2-flowered: stamens exserted from the corolla tube. *copiosa.*
        Leaflets obreniform. .. .. *Luederitzii.*

The character of the yellow flowers has been retained for this sub-section, since there appear to be no species in the section Cernuae with both yellow and reddish or white flowered forms, a variation frequently found in other sections. The species *O. copiosa* Bolus f. and *O. haedulipes* Salter are possibly more closely related to the sub-section Costatae, but they are included here on account of this obvious floral character.

The reason for reverting to the name *pes caprae* in the place of *O. cernua* Thunb., was explained in Vol. V, p. 47 of this Journal. *O. haedulipes* is described on p. 5 of the current number (Fig. 4) and *O. Knuthiana* appeared in Vol. II, p. 145.

The following species, which have been attributed to this section, are omitted for the reasons given.

O. kububensis R. Knuth is indistinguishable from *O. Luederitzii* Schinz.

O. kuibisensis R. Knuth is a monstrous form of O. *pes caprae*, L.

O. pseudo-cernua R. Knuth has white flowers (see sub-sec. Costatae).

O. pusilla R. Knuth (non Jacq.). *Schultz* 133 = *O. Luederitzii* : *Schultz* 187*a* = *O. copiosa* Bolus f.

O. sericea L. f., which is merely a variety of *O. pes caprae*.

SUB-SECTION II. LIVIDAE Salter.

O. dentata Jacq.	Jacq. Oxal. 38. t. 7.
O. livida Jacq.	Jacq. Oxal. 39. t. 8.
O. lateriflora Jacq.	Jacq. Hort. Schoenbr. II, 41. t. 204.

- Leaflets not divided below the middle : contractile root acting horizontally. . . .. *dentata.*
- Leaflets divided below the middle or nearly to the base. ..
  - Bulb without a contractile root : rhizome producing lateral runners. .. .. *lateriflora.*
  - Contractile root acting vertically : rhizome not producing lateral runners. .. .. *livida.*

In this group the ovary chambers are 2-ovuled or more rarely 1-ovuled, and the pedicels and sepals are clothed with glandular hairs. In the great majority of the specimens one or more of the peduncles arise from a bract on the stem, some distance below the leaves. All three, particularly *O. lateriflora* and *O. livida*, frequently commence flowering before the leaves open and, with the full development of the leaves, the plants become bushy. The outer tunics of the bulbs are easily separable, indistinctly longitudinally furrowed and have golden-brown hairs at the apex, thus differing from those of the sub-section Stellatae, in which the bulbs are smooth and glabrous with a well-developed apical beak.

O. dentata Jacq. This very distinct species, which is abundant in the Cape Peninsula, has been placed by previous authors as a variety of *O. livida* Jacq., without citation of any specimens. The character from which Jacquin named it, viz. the small teeth at the apex of the sepals, is an uncommon one, at least to the degree shown in the figure, and one which I have only observed occurring to such a marked extent in one small colony out of many plants examined. By an unfortunate coincidence Jacquin's specimen had this peculiarity which in itself is certainly not specific.

Both Sonder in Flora Capensis I. 319 and R. Knuth in Pflrch.Oxal. 308, have assumed this plant to be *O. livida* and *described* it as such, citing such specimens as E. & Z. 653 (Lion's Mt.) and 654 (Table Mt.), whereas *O. livida* is quite a different species and one which does not occur on the Cape Peninsula.

The difference in the shape of the leaflets in these two species is fairly well shown in Jacquin's figures, but it is in the root-system that the most striking distinction appears. The narrow-ovoid bulb of *O. dentata* produces a long contractile root up to 1 cm. in diam. and it is the only species known to me in which the contractile root acts horizontally, dragging the new bulb at a more or less constant level to several inches from the parent plant and, for this reason, the bulb is always found lying horizontally in the soil. (Plate I, 1.) This peculiarity is also found in the species *O. lateriflora* Jacq. and *O. purpurata* Jacq., but for quite a different reason as will be explained later. The bulbils in *O. dentata* are sessile on the rhizome or very nearly so. The flowers are pale rose or violaceous.

In *O. livida*, a less common species with rosy or rosy-purple flowers (Plate III, 1) and also in its variety *altior* Salter from Clanwilliam Division (Plate II, 1), the leaflets are more deeply lobed. The bulb is larger, broader in proportion to its length and lies upright, the contractile root being much thicker (in var. *altior* up to 3 cm. in diam.) and acting vertically (Plate II, 2). The bulbils are sessile on the rhizome as in *O. dentata*.

O. lateriflora, of which Jacquin's figure is an exceptionally elongated specimen, is again distinguished by its root-system. The bulb does not produce a contractile root, but long, rather fleshy horizontal runners (20 cm. or more long) emerge from the rhizome, sometimes branching, and it is upon the tips of these that the bulbils form. (Plate I, 2.) At maturity they lie upon their sides as is the case in *O. dentata*, but for a very different reason. These runners, just commencing to develop, are shown in Jacquin's figure. *O. lateriflora*, although it does not occur in the Cape Peninsula, is a common plant in the coastal belt as far north as Piquetberg.

Sonder, deceived by the superficial similarity and knowing nothing of the root-system, was wrong in placing the Clanwilliam specimens E. & Z. 662, 663 under *O. lateriflora* (see *O. livida* Jacq., var. *altior* Salter) (Plate II, 1.)

Schlechter 2546, Uitenhage, cited under this species in Pflrch. is *O. stellata* E. & Z.

SUB-SECTION III. PURPURATAE R. Knuth.

O. purpurata Jacq.	Jacq. Hort. Schoenbr. III, 57. t. 356.
O. Bowiei Lindl.	Bot. Reg. XIX, t. 1585.
O. semiloba Sond.	Flora Capensis I, 350.

Bulb without a contractile root: rhizome producing lateral runners: sepals ecallous. .. .. *purpurata.*
Bulb with a contractile root: rhizome without runners.
  Sepals ecallous. .. .. *Bowiei.*
  Sepals with rusty apical calli. .. .. *semiloba.*

There is a superficial resemblance between the species in this sub-section. In addition to the distinctive characters given in the key, the leaflets are usually much larger and more broadly lobed than in the sub-section Lividae.

O. purpurata Jacq. is figured in Hort. Schoenbr. with underground lateral runners, and it is practically certain that none of the specimens hitherto cited under this name is in reality Jacquin's species. Plants, however, grown from bulbs collected on Van Rhyn's Pass in 1931 (*Salter* 702), *i.e.* at least *near* the route taken by the Austrians Boos and Scholl, who collected Oxalis for Jacquin,* have been for some years in cultivation at Kirstenbosch and are undoubtedly identical with *O. purpurata* as figured by Jacquin. The rhizome produces lateral runners, some of which emerge and make leaf (as figured) while new bulbils are formed on the tips of others (Plate IV. 1.). The bulb is broadly ovoid, producing no contractile root and lies on its side in the same way as that of *O. lateriflora* Jacq. and the sepals are without glandular hairs or apical calli. The leaflets are an intense purple on the lower surface.

O. Bowiei Lindl. is founded on the figure cited above and there is probably no type specimen. The figure *O. Bowieana* Lodd. Bot. Cab.

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*All Jacquin's Oxalis, with the exception of *O. ciliaris*, which has not been recorded from west of Swellendam, are from the western coastal belt as far north as Kamieskroon in Namaqualand. Many comparatively common species are missing, but, as it was, his success in growing Oxalis in Europe was remarkable and allowances must be made for those which did not flower. He figures none of the species which occur in the more easterly parts of South Africa.

XVIII, t. 1782 gives a better representation of the plant and, although of earlier date, was published without analysis. I believe *O. vigilans* L. Bolus to be a form of this species. Neither Sonder nor R. Knuth make any mention of the bulb of *O. purpurata* and its supposed varieties, but the species *O. Bowiei*, as understood by Hildebrand (Lebensverhältnisse der Oxalis-Arten, 1884) was that exemplified by E. & Z. 651 from Uitenhage, in which the broadly subuloid bulbs produce a contractile root.

In both this species and in *O. semiloba* Sond. the pedicels and sepals are sometimes clothed with glandular hairs and sometimes without them. Much importance has been attached to the degree of indentation or lobing of the leaflets, a character which seems to be unreliable, but if *O. semiloba* is to be considered a distinct species, it apears to be best separated by the presence of rusty apical calli on the sepals. In the specimens which appear to be *O. Bowiei*, i.e. those without such calli, the flowers are fairly large and the leaflets are lightly incised, whereas in those with apical calli on the sepals, they usually tend to be more deeply lobed, sometimes to the middle, and they generally have smaller flowers. The leaflets are, however, very variable and the species *O. semiloba* at present comprises one of those large composite groups so common in this genus. The *type*, *Burke & Zey.* 271 is a form with smallish leaflets.

In Pflrch. Oxal. R. Knuth gives an amplified description of *O. purpurata* which seems to be intended to include all the so-called varieties. His var. α *anthelmintica* A. Rich. Tent. Fl. Abyssinia, though I have not seen the actual *type*, is certainly not Jacquin's species, which, although it is the *type* of *O. purpurata*, has been reduced to a secondary position as var. β *Jacquinii* (originally var. α *Jacquini* Sond. in Flora Capensis I.350). The specimens attributed here by Sonder are evidently a form of *O. semiloba* with lightly incised leaflets, while none of the specimens cited in Pflrch. is the true *O. purpurata*. *Wood* (*Galpin* 3243), East London, is the species which I have described as *O. stenorhyncha*, (Plate V, 1.), *Schlechter* 6362, Tzitza River, is *O. semiloba* Sond. and *Range* 355, Kuibis, which has an elongate beaked bulb, with conspicuous longitudinal ridges, is the species which I have named *O. purpurascens* in sub-section Costatae (Plate IV. 2.) and judging from the localities given, it is almost certain that the remainder of the specimens cited from South West Africa are also that species.

Var. γ *petiolaris* (E. Mey) Sond., from Pondoland (not Namaqualand) and var. δ *austro-orientalis* R. Knuth—e.g. *Tyson* 1415, Clydesdale, Griqualand East—are forms of *O. semiloba.*

O. Bowiei Lindl, as exemplified by E. & Z. 651, Uitenhage, should be retained as a separate species. Its geographical distribution, from Uitenhage to Great Kei River and as far north as the Winterberg Range, is much more limited than that of the *semiloba* group, which extends to Lourenço Marques.

O. latifolia H. B. & K., a species introduced from Mexico and said to be a troublesome weed in the Eastern Districts of the Union, is often confused with *O. semiloba* in herbaria. It belongs to an entirely different Section—*Ionoxalis* (Small) R. Knuth and may be distinguished by its broadly triangular leaflets and by the fact that it has no underground stem or rhizome, the leaves and peduncles arising direct from the bulb. The bulbils form on the tips of underground runners which emerge from the *base* of the bulb. (Plate III. 2.).

SUB-SECTION IV. COSTATAE Salter.

- Corolla reddish-purple. .. .. *purpurascens.*
- Corolla white. .. .. *pseudo-cernua.*

This group is characterised by the large elongate longitudinally-ridged brown bulb. Both species, which occur in South West Africa, are only known to me from herbarium specimens, but they have been included here in order to rectify previous misconceptions. *O. purpurascens* Salter has already been mentioned (p. 6 and 16) and *O. pseudo-cernua* R. Knuth, which has rather small white flowers, was erroneously attributed to the yellow-flowered sub-section Eucernuae in Pflrch. In addition to the *type* (*Range* 1716, Schakalskuppe), *Dinter* 6231, Zwartaus, distributed under the wrong name *albella* and *Dinter* 3568, Aus, are this species.

SUB-SECTION V. STELLATAE R. Knuth.

- Peduncles 1—2-flowered: stem not exserted... .. .. *anomala.*
- Peduncles usually more than 2-flowered.
  - Pedicels and sepals clothed with glandular hairs. *stellata,* var. *glandulosa.*
  - Pedicels and sepals without glandular hairs.
    - Stem exserted.
      - Corolla brick-red: beak longer than the bulb... *stenorhyncha.*
      - Corolla violaceous or rosy: beak not longer than the bulb.
        - Leaflets divided to below the middle, usually nearly to the base: sepals with apical calli. .. .. *stellata.*
        - Leaflets divided to the middle or less: sepals without apical calli. .. .. *Lindaviana.*
    - Stem not normally exserted: sepals with apical calli.
      - Leaflets divided nearly to the base. .. .. *dichotoma.*
      - Leaflets divided to the middle or less... .. *caprina.*

This sub-section is distinguished by the smooth bulbs which have an acute apical beak, but there is considerable variation in the depth of bilobing of the leaflets. The rhizome never produces lateral runners. The section is complex and which different forms should be given the status of species and varieties can only be a matter of opinion.

The typical form of *O. stellata* E. & Z. has very deeply bilobed leaflets and is frequently confused with *O. lateriflora* in herbaria. In addition to the difference in the bulb, the lobes of the leaflets taper somewhat towards a comparatively acute apex, whereas in all other forms the lobes are obtuse and slightly narrowed towards the base. It is plentiful about Port Elizabeth and extends as far west as Caledon Division.

O. caprina, L., as it grows in the Cape Peninsula, is a puzzling plant. It is common as a weed in gardens and hedge-rows or at least near cultivation, though it does sometimes occur on hillsides or sandy flats where it appears to be a native. As far as can be ascertained all the Cape Peninsula plants have short-styled flowers and apparently never produce seed. It spreads, however, very readily by its bulbils, particularly when they are disturbed by cultivation.

It is difficult to understand how this form has become isolated locally, for the species, or at least slight variants of it, extends as far east as Alexandria Division and all three stylar forms occur and are fertilised normally. The specimens from Alexandria Division, e.g. *Galpin* 10802 and *Pillans* 8526 are rather larger in all respects than the typical form.

O. Lindaviana Schltr. is only known from one collecting in Piquenier's Kloof (now known as Grey's Pass) near Citrusdal and although I have searched for it several times in that locality I have been unable to find it. The bulb is not known, but, except for the long exserted stem and ecallous sepals, the plant appears to be almost identical with *O. caprina* and is possibly a local form of that species.

O. anomala Salter and *O. stellata* E. & Z. var. *glandulosa* Salter have already been described in this Journal and two new species *O. stenorhyncha* Salter (Plate V. 1.) and *O. dichotoma* Salter (Fig. 3, page 3) and two new varieties *O. stellata* E. & Z. vars. *montaguensis* Salter (Plate V. 2.) and *gracilior* Salter are described elsewhere in this number.

The species *O. angustiloba* R. E. Fries and *O. uhehensis* Engler from Rhodesia and Tropical Africa should probably be placed in the sub-section Purpuratae.

SUB-SECTION VI. GOETZEA R. Knuth.

This sub-section is founded on the entire leaflets and seems to be highly artificial. Since there is no description of the bulb of any of the six species included, it is perhaps best to retain it until the plants are better known. *O. Davyana* R. Knuth (*O. Galpinii* Burtt Davy, non Schlechter) is the only species which occurs within the Union, the others being from Madagascar and Tropical Africa. It has only been collected by Dr. E. E. Galpin in the Umlomati valley in the neighbourhood of Barberton and in the Havelock concession, Swaziland and from the appearance of the specimens it is probably nearly related to *O. semiloba* Sond. A re-discovery of this species and specimens with bulbs would be very welcome.

One of the principal objects of this paper is to point out the vital importance of the bulb as a character in distinguishing Oxalis and, irksome as it may sometimes prove, I would urge collectors always to obtain at least one specimen if they wish to have their plants determined correctly. It is also to be hoped that the days of creating new species, without any description of the bulb, are finally passed.

I am much indebted to Professor R. S. Adamson of the University of Cape Town for kindly taking the photographs illustrating this paper and also to the Curators of the Bolus Herbarium, the South African Museum, Cape Town, the National Herbarium, Pretoria and the Albany Museum, Grahamstown, for facilities in examining herbarium specimens

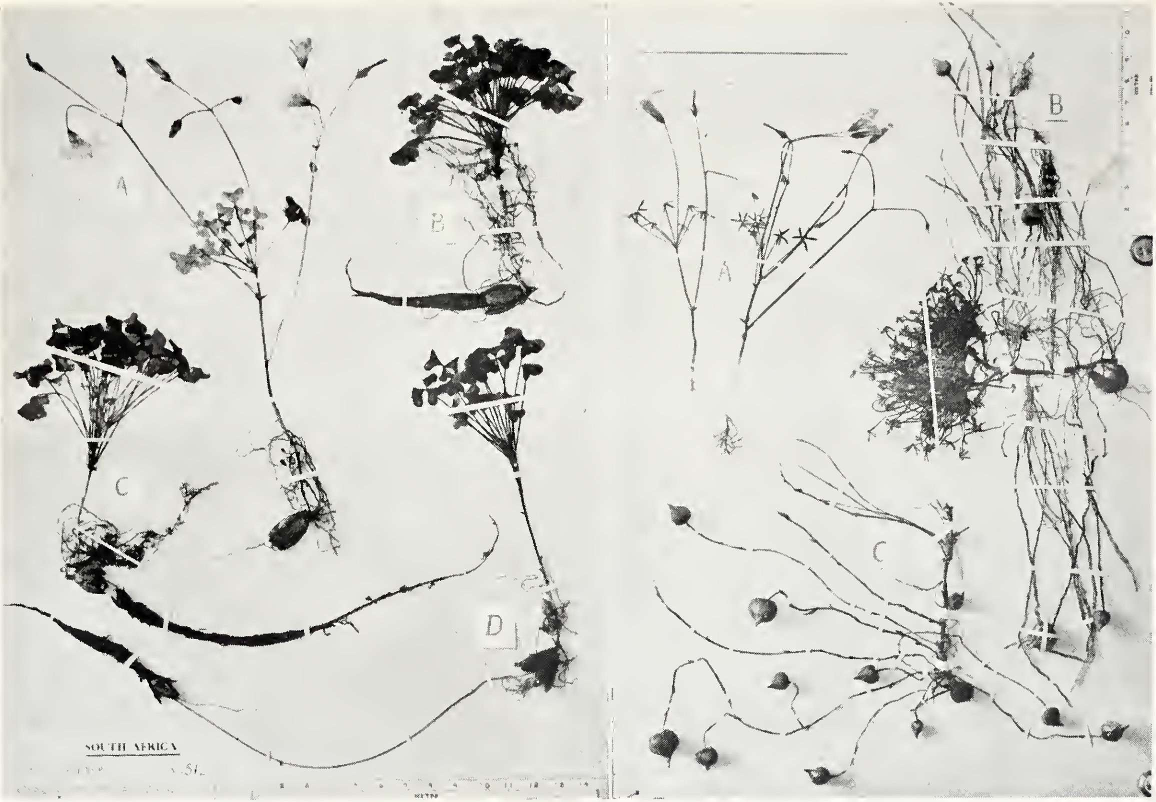
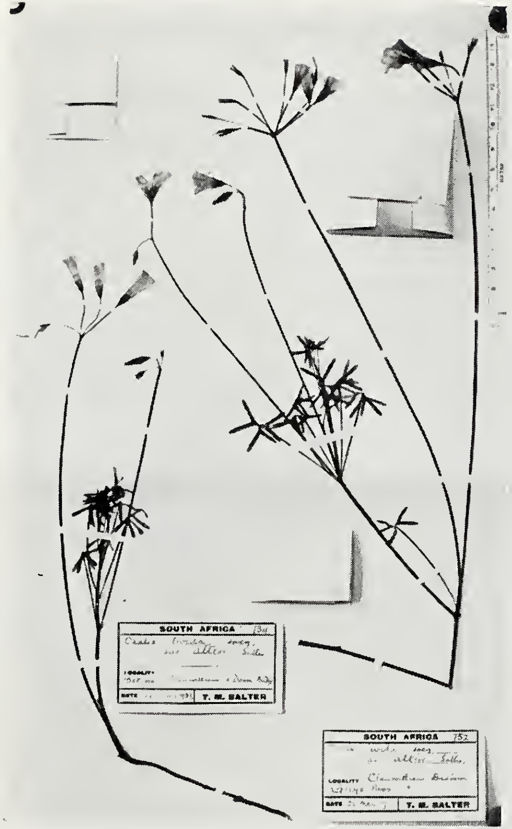


PLATE 1.

(1). *O. dentata* Jacq. A. Plant flowering. B. Contractile root developing. C. New bulb just leaving the old tunics. D. New bulb nearing its final position.

(2). *O. lateriflora* Jacq. A. Plant flowering. B. Bushy stage after flowering, with the runners well developed. C. Plant after dying off of the leaves.



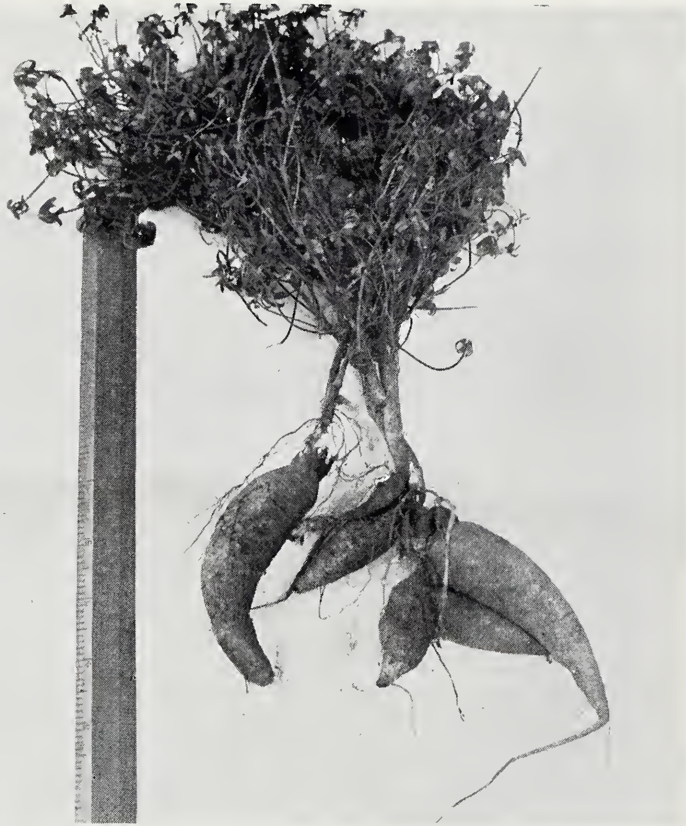


PLATE II.

(1). *O. livida* Jacq. var. *altior* Salter. Plant flowering. The bulb is similar to that of *O. livida* Jacq. (Pl. III (1).

(2). *O. livida* Jacq. var. *altior* Salter. Bushy stage after flowering, showing the large contractile root.

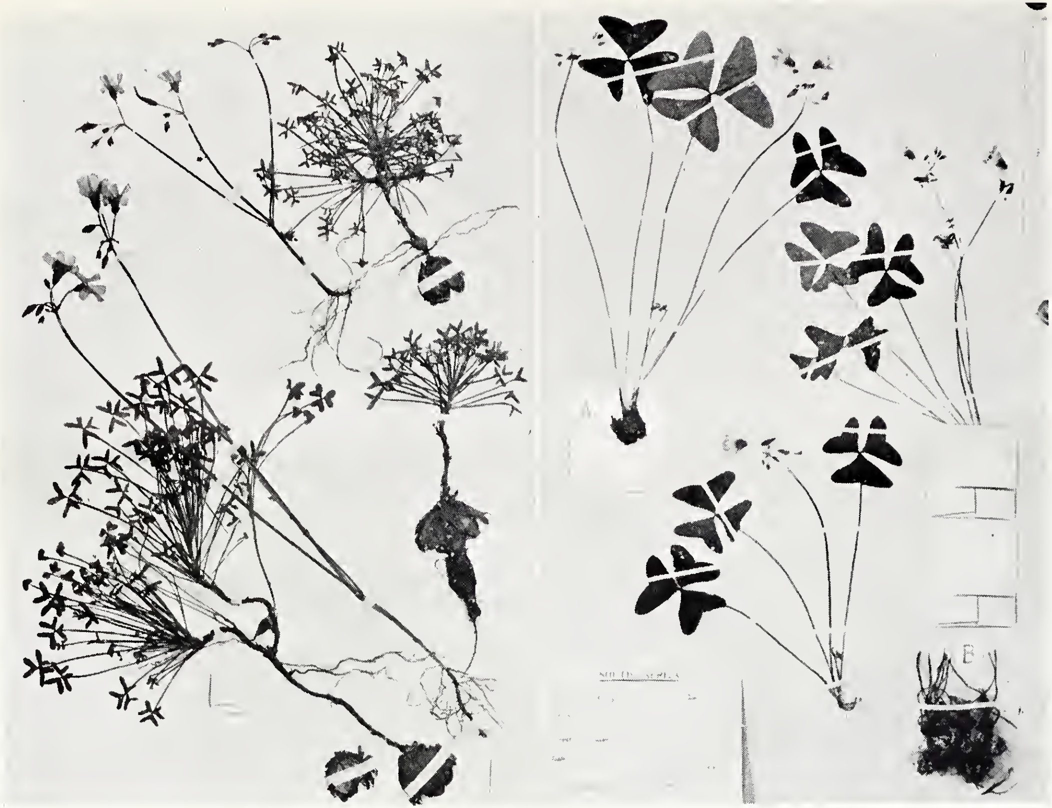


PLATE III.

(1). *O. livida* Jacq. Showing the flowering stage, the bushy growth after flowering and a contractile root much shrivelled in drying.

(2). *O. latifolia* H. B. & K. A. flowering plant. B. An old bulb with a mass of bulbils.

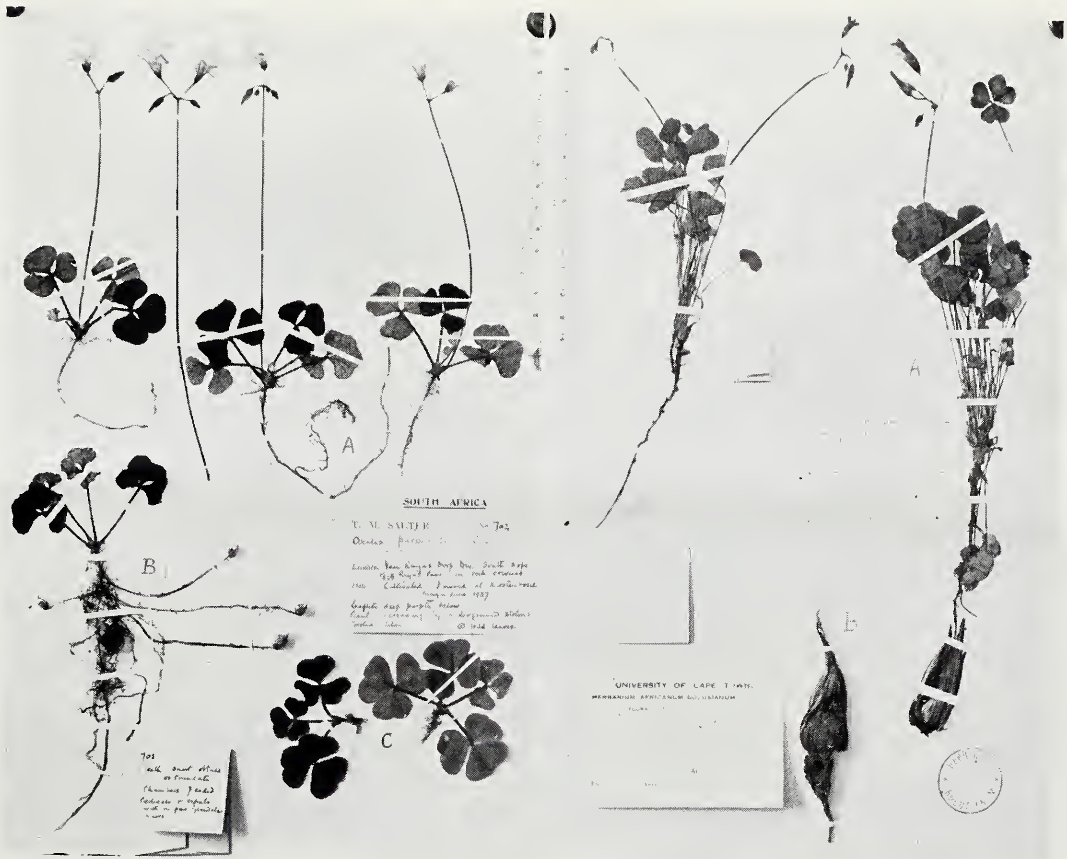
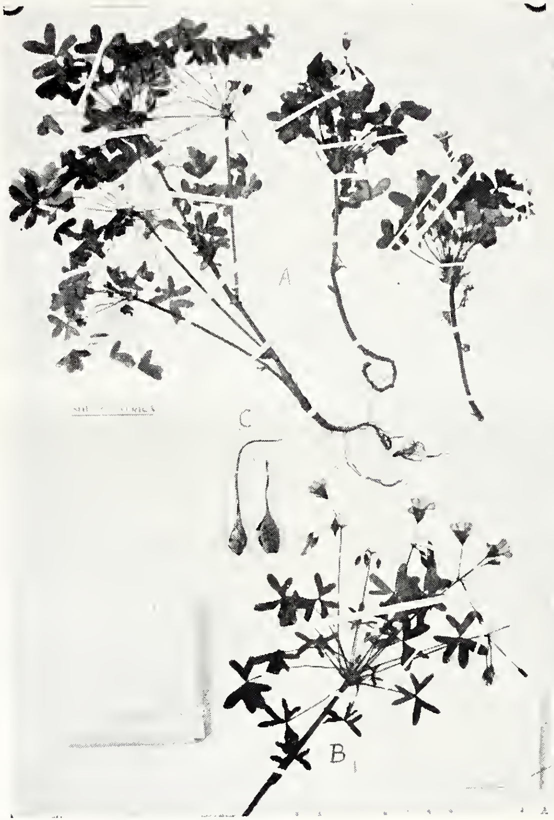


Plate IV.

(1). *O. purpurata* Jacq. (Cult.). A. A " runner " commencing to make leaf. B. Runners producing bulbils. C. Leaves of the wild plant.

(2). *O. purpurascens* Salter. A. *Pearson* (Percy Sladen Memorial Expedition, 9600: type). B. Bulb of *Range* 355.



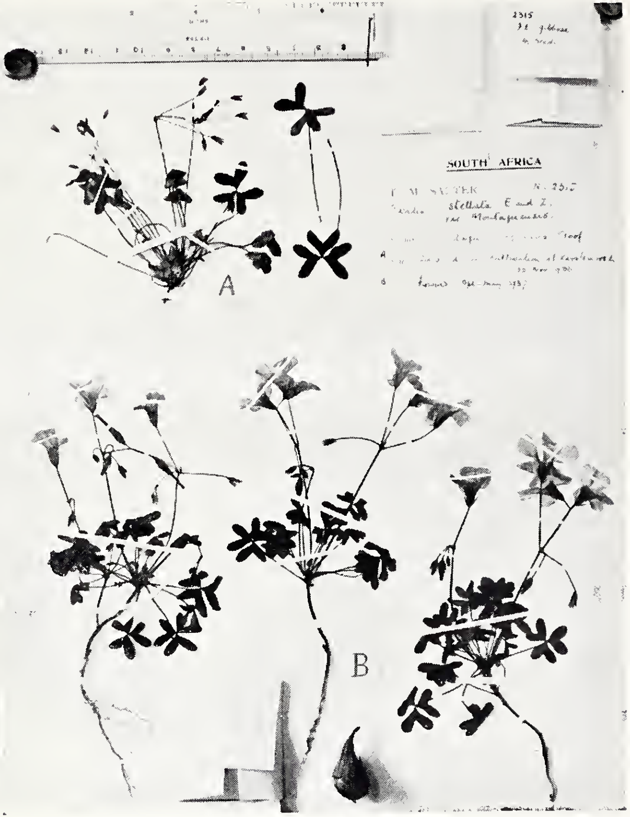


PLATE V.

(1). *O. stenorhyncha* Salter. A. Wild plants. B. A cultivated plant. C. Bulbs. (*Leighton*, Salter 2290.)

(2). *O. stellata* E & Z. var. *montaguensis* Salter. A. A wild plant showing aerial bulbils. B. Cultivated plants and bulb.